

WHAT IS CLAIMED IS:

1. A recorder for recording a performance represented by pieces of first sort of music data in ensemble with a playback of a music passage represented by pieces of second sort of music data different in format from said first sort of music data, comprising:

an interface connected to

a data source of said pieces of said first sort of music data,

another data source of said pieces of said second sort of music data and

a destination to which a music data file is supplied; and

a data processing unit connected to said interface, extracting pieces of reference characteristic data representative of particular features of an audio waveform expressing said music passage from said pieces of said second sort of music data, and forming said pieces of said first sort of music data, said pieces of reference characteristic data and pieces of time data representative of timing to reproduce tones produced in said performance into said music data file for supplying said music data file through said interface to said destination.

2. The recorder as set forth in claim 1, in which said data processor extracts pieces of reference correlation data representative of variation of certain frequency components from said pieces of second sort of music data as said pieces of said reference characteristic data, and said pieces of reference correlation data are used in a correlation analysis between said music passage and another music passage.

3. The recorder as set forth in claim 2, in which said music passage occupies a head portion of a piece of music, and said data processing unit further stores a time at which a certain piece of reference correlation data was produced from a piece of said second sort of music data during the performance of said head portion into said music data file.
4. The recorder as set forth in claim 1, in which the format for said piece of said first sort of music data is defined in MIDI (Musical Instrument Digital Interface), and the format for said pieces of said second sort of music data is defined in Red Book for compact discs.
5. The recorder as set forth in claim 4, in which said data processor extracts pieces of reference correlation data representative of variation of certain frequency components from said pieces of second sort of music data as said pieces of said reference characteristic data, and said pieces of reference correlation data are used in a correlation analysis between said music passage and another music passage.
6. The recorder as set forth in claim 5, in which said music passage occupies a head portion of a piece of music, and said data processing unit stores said pieces of reference correlation data and a time at which a certain piece of reference correlation data was produced during said performance of said head portion in said music data file in the form of system exclusive event code.
7. The recorder as set forth in claim 6, in which said certain piece of reference correlation data occupies the head of the series of the pieces of said second sort of music data representative of said music passage immediately after

the pieces of said second sort of music data representative of silence so that said music passage starts at said time.

8. The recorder as set forth in claim 4, in which said data processor extracts pieces of reference correlation data at a head portion representative of variation of a certain frequency components from the pieces of said second sort of music data representative of a head portion of said music passage and other pieces of reference correlation data at an end portion representative of variation of a certain frequency components from the pieces of said second music data representative of an end portion of said music passage as said pieces of said reference characteristic data, and said pieces of reference correlation data at said head portion and said other pieces of reference correlation data at said end portion are used in a correlation analysis between said music passage and another music passage.

9. The recorder as set forth in claim 8, in which said data processing unit stores said pieces of reference correlation data at said head portion, a time at which a certain piece of said reference correlation data at said head portion was produced from a pieces of said second sort of music data during the performance of said head portion, said other pieces of said reference correlation data at said end portion and a time at which another certain piece of said reference correlation data at said end portion was produced from another piece of said second sort of music data during the performance of said end portion in said music data file in the form of system exclusive event code.

10. The recorder as set forth in claim 9, in which said certain piece of said reference correlation data at said head portion and said another certain piece

of said reference correlation data at said end portion occupy a head of the series of the pieces of said second sort of music data and an end of said series of said pieces of said second sort of music data so that the length of said music passage is determined on the basis of said times.

11. The recorder as set forth in claim 1, in which said data processing unit extracts abrupt changes of an attribute of sound from said pieces of said second sort of music data as said pieces of said reference characteristic data, and said abrupt changes are stored in said music data file together with other pieces of said time data representative of timing at which said abrupt changes take place.

12. The recorder as set forth in claim 11, in which said abrupt changes are extracted from the entire music passage so that another music passage is made consistent with said music passage by making said abrupt changes correspond to abrupt changes extracted from pieces of said second sort of music data representative of said another music passage.

13. The recorder as set forth in claim 4, in which said data processing unit extracts abrupt changes of an attribute of sound from said pieces of said second sort of music data as said pieces of said reference characteristic data, and said abrupt changes are stored in said music data file together with other pieces of said time data representative of timing at which said abrupt changes take place in the form of system exclusive event code and in the form of time data code.

14. The recorder as set forth in claim 13, in which said abrupt changes are extracted from the entire music passage so that another music passage is made

consistent with said music passage by making said abrupt changes correspond to abrupt changes extracted from pieces of said second sort of music data representative of said another music passage.

15. The recorder as set forth in claim 1, in which an automatic player piano serves as said data source so that said pieces of said first sort of music data are supplied to said interface while a user is fingering on said automatic player piano, and a compact disc loaded into a compact disc driver serves as said another data source so that said piece of said second sort of data are transferred from said compact disc to said interface while said user is fingering on said automatic player piano.

16. A player for reproducing tones in a performance represented by pieces of first sort of music data in ensemble with a playback of a music passage represented by pieces of second sort of music data different in format from said first sort of music data, comprising:

- an interface connected to

- a source of music data file storing at least one music data file containing said pieces of said first sort of music data, pieces of reference characteristic data representative of particular features of an audio waveform represented by other pieces of said second sort of music data expressing said music passage and pieces of time data representative of timing to reproduce said tones in said performance,

- a data source of said pieces of said second sort of music data,

- a sound source for producing said tones on the basis of said pieces of said first music data and

another sound source for producing other tones from said pieces of said second sort of music data; and

a data processing unit connected to said interface, extracting pieces of objective characteristic data representative of particular features of another audio waveform expressing said music passage from said pieces of second sort of music data, comparing said pieces of objective characteristic data with said pieces of reference objective characteristic data so as to find time differences between said particular features of said audio waveform and said particular features of said another audio waveform, rescheduling timing to supply said pieces of said first sort of music data to said sound source by changing said pieces of time data, and supplying said pieces of said second sort of music data to said another sound source and said pieces of said first sort of music data to said sound source at the timing represented by the pieces of time data already changed.

17. The player as set forth in claim 16, in which said pieces of said reference characteristic data and said pieces of said objective characteristic data are representative of a variation of certain frequency components extracted from said other pieces of said second sort of music data and a variation of said certain frequency components extracted from said pieces of said second sort of music data, and said data processing unit compares said pieces of said reference characteristic data with said pieces of said objective characteristic data through a correlation analysis therebetween.

18. The player as set forth in claim 17, in which said pieces of said reference characteristic data are extracted from said pieces of said second sort of music

data representative of a certain portion of said music passage, and said data processing unit carries out said correlation analysis between said pieces of said reference characteristic data and said pieces of said objective characteristic data for finding a portion of said music passage corresponding to said certain portion in said music passage represented by said pieces of said second sort of music data.

19. The player as set forth in claim 18, in which said certain portion is a head portion of said music passage so that said data processing unit makes said playback of said music passage start at timing same as that in a playback of said music passage represented by said other pieces of music after said correlation analysis.

20. The player as set forth in claim 18, in which said certain portion is a head portion and an end portion of said music passage so that said data processing unit determines a difference between the length of said playback of said music passage represented by said pieces of said second sort of music data and the length of said playback of said music passage represented by said other pieces of said second sort of music data after said correlation analysis, and said data processing unit reschedules said timing to supply said pieces of said first sort of music in such a manner as to minimize the difference.

21. The player as set forth in claim 16, in which said pieces of said reference characteristic data and said pieces of said objective characteristic data are representative of certain abrupt changes of an attribute of sound found in said audio waveform and other abrupt changes of said attribute of sound found in said another audio waveform, respectively, and data processing unit makes

said other abrupt changes corresponding to said certain abrupt changes for determining said time differences.

22. The player as set forth in claim 21, in which said attribute is the loudness of sound in a certain frequency range.

23. The player as set forth in claim 16, in which the format for said pieces of said first sort of music data and the format for said pieces of said second sort of music data are defined in MIDI (Musical Instrument Digital Interface) standards and Red Book for compact discs, respectively.

24. The player as set forth in claim 23, in which said pieces of said reference characteristic data stored in said at least one music data file in the form of system exclusive event code and said pieces of said objective characteristic data are representative of a variation of certain frequency components extracted from said other pieces of said second sort of music data and a variation of said certain frequency components extracted from said pieces of said second sort of music data, respectively, and said data processing unit compares said pieces of said reference characteristic data with said pieces of said objective characteristic data through a correlation analysis therebetween.

25. The player as set forth in claim 24, in which said pieces of said reference characteristic data are extracted from said pieces of said second sort of music data representative of a certain portion of said music passage, and said data processing unit carries out said correlation analysis between said pieces of reference characteristic data and said pieces of objective characteristic data for finding a portion corresponding to said certain portion in said music passage represented by said pieces of said second sort of music data.



26. The player as set forth in claim 25, in which said certain portion is a head portion of said music passage so that said data processing unit makes said playback of said music passage start at timing same as that in a playback of said music passage represented by said other pieces of music after said correlation analysis.

27. The player as set forth in claim 25, in which said certain portion is a head portion and an end portion of said music passage so that said data processing unit determines a difference between the length of said playback of said music passage represented by said pieces of said second sort of music data and the length of said playback of said music passage represented by said other pieces of said second sort of music data after said correlation analysis, and said data processing unit reschedules said timing to supply said pieces of said first sort of music in such a manner as to minimize the difference.

28. The player as set forth in claim 23, in which said pieces of said reference characteristic data and said pieces of said objective characteristic data are representative of certain abrupt changes of an attribute of sound found in said audio waveform and other abrupt changes of said attribute of sound found in said another audio waveform, respectively, and data processing unit makes said other abrupt changes corresponding to said certain abrupt changes for determining said time differences.

29. The player as set forth in claim 28, in which said attribute is the loudness of sound in a certain frequency range.

30. The player as set forth in claim 23, in which a compact disc loaded in a compact disc driver, an automatic player piano and an audio unit serve as said data source, said sound source and said another sound source, respectively.

31. A synchronous player system carrying out at least a preliminary recording and a synchronous playback, comprising:

- an interface connected to

- a data source of pieces of first sort of music data representative of tones to be produced in a performance,

- another data source of pieces of second sort of music data different in format from said first sort of music and expressing a music passage and other pieces of said second sort of music data expressing said music passage,

- a source of music data file storing at least one music data file containing said pieces of said first music data, pieces of reference characteristic data representative of particular features of an audio waveform represented by said pieces of second sort of music data and pieces of time data represented by timing to produce said tones in said performance,

- a sound source producing said tones on the basis of said pieces of first sort of music data and

- another sound source producing other tones from said other pieces of said second music data; and

- a data processing unit connected to said interface and communicating with said data source, said another and said source of music data file for said preliminary recording and with said source of music data file, said sound source and said another sound source for said synchronous playback,

in which

said data processing unit extracts said pieces of reference characteristic data from said pieces of said second sort of music data, and forms said pieces of said first sort of music data, said pieces of reference characteristic data and said pieces of time data into said music data file for supplying said music data file through said interface to said source of music data file,

and in which

said data processing unit extracts pieces of objective characteristic data representative of particular features of another audio waveform expressing said music passage from said other pieces of second sort of music data, compares said pieces of objective characteristic data with said pieces of reference objective characteristic data so as to find time differences between said particular features of said audio waveform and said particular features of said another audio waveform, reschedules timing to supply said pieces of said first sort of music data to said first sound source by changing said pieces of time data, and supplies said other pieces of said second sort of music data to said another sound source and said pieces of said first sort of music data to said sound source at the timing represented by the pieces of time data already changed.

32. The synchronous player system as set forth 31, in which the format for said pieces of said first sort of music data and the format for said pieces of said second sort of music data are defined in MIDI (Musical Instrument Digital Interface) standards and Red Book for compact discs, respectively.

33. The synchronous player system as set forth in claim 32, in which an automatic player piano serves as said data source and said sound source, and compact discs loaded in a compact disc driver and an audio unit serve as said another data source and said another sound source, respectively.